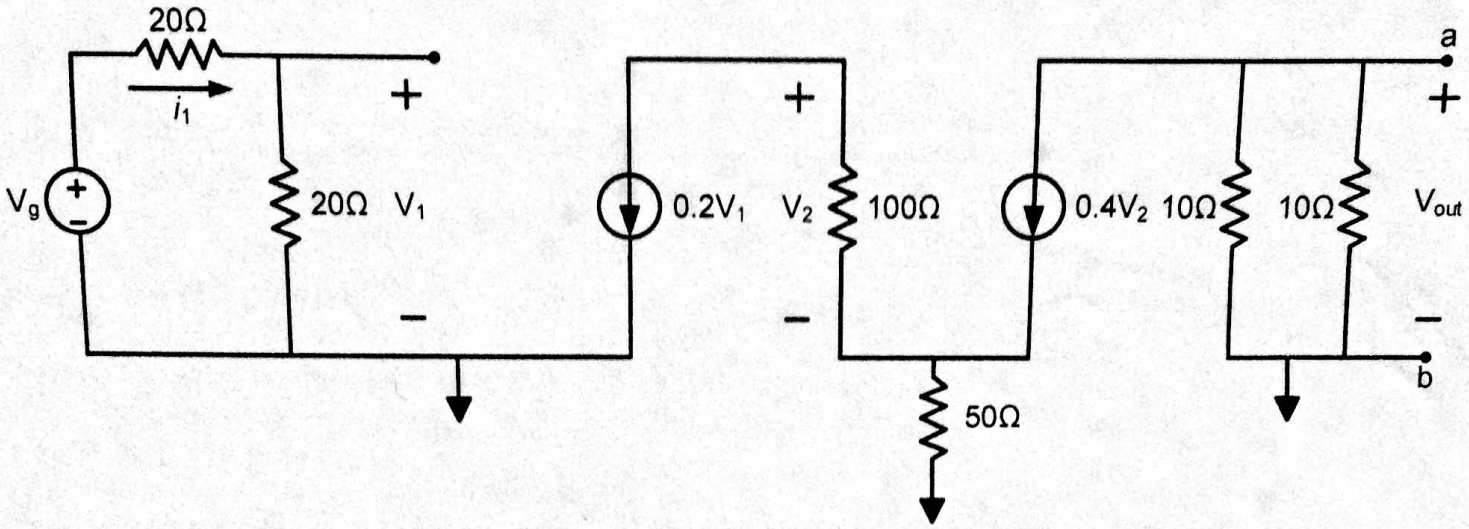
Problem 1 (30 points):

(1) Find Vout/Vg.
(2) Assuming Vg is the input signal, find the Thevenin equivalent circuit looking into the terminals a-b.



Problem 2 (20 points):

Use the solution from Problem 1,

(a) If Vg = 2VDC, what is the voltage at Vout?

(b) If Vg = 7V DC, what is the voltage at Vout?

(c) If Vg = 2cos(10t), what is the output voltage at Vout? Make a rough sketch of Vout and Vg.

(d) Note that this is an amplifier, i.e. the output is linearly related to the input by a gain value. Mathematically, that is express as: Vout/Vin = gain.

For the circuit above, what is the variable for Vout and Vin? What is the numerical gain value?

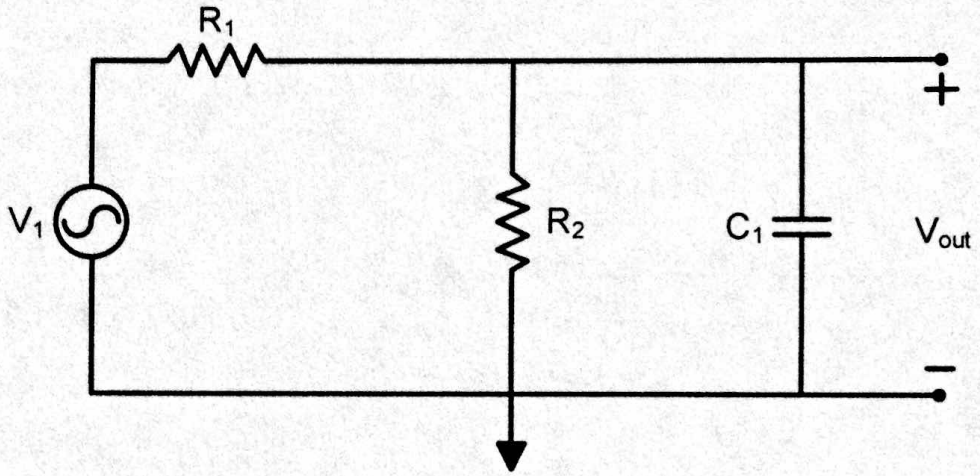
Problem 3 (10 points):

Sketch the following waveforms. Identify the DC component of the waveform and the AC component of the waveform.

(a) $Vs = 5V\cos(2\pi t)$

(b) $Vs = 1V - 1V\sin(3t)$

Using the following circuit for Problems 4-7, assuming $R_1 = 20\Omega$, $R_2 = 100\Omega$, and $C_1 = 3mF$ (i.e. $3x10^{-3}F$)



Problem 4 (10 points)

Derive the transfer function $H(s) = V_{out}(s)/V_1(s)$.

Problem 5 (10 points)

Use PSPICE to draw and print out the circuit schematic.

Problem 6 (10 points)

Simulate the circuit in PSPICE to obtain the Bode Plot of $H(s) = V_{out}(s)/V_1(s)$.

Problem 7 (10 points)

Use MATLAB and the results of the hand derivation to obtain the Bode Plot.

Note: PSPICE plots the results over frequency in Hz and derived transfer function uses ω in radians/sec.